Geosyntec consultants

engineers | scientists | innovators

GROUNDWATER MONITORING PLAN FOR PERCHLORATE ANALYSIS

Shieldalloy Metallurgical Corporation Superfund Site

Prepared for

Shieldalloy Metallurgical Corporation
35 South West Boulevard
Newfield, New Jersey 08344

Prepared by

Geosyntec Consultants, Inc.
7 Graphics Drive, Suite 106
Ewing, New Jersey 08628

Project JR0241

May 2019

GROUNDWATER MONITORING PLAN FOR PERCHLORATE ANALYSIS

Shieldalloy Metallurgical Corporation Superfund Site

Prepared for

Shieldalloy Metallurgical Corporation
35 South West Boulevard
Newfield, New Jersey 08344

Prepared by

Geosyntec Consultants, Inc.
7 Graphics Drive, Suite 106
Ewing, New Jersey 08628

Seth Kellogg, P.G.
Senior Geologist

John Persico, P.G.
Principal

Project Number: JR0241

May 2019

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

LIST OF ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

COCs	Contaminants of Concern
CPS	calcium polysulfide
DO	dissolved oxygen
EDDs	Electronic Data Deliverables
EISB	Enhanced In Situ Bioremediation
EVO	Emulsified Vegetable Oil
FS	Feasibility Study
GIWP	Groundwater Inverstigation Work Plan
GMP	Groundwater Monitoring Plan
gpm	gallons per minute
GWQS	New Jersey Ground Water Quality Standard
HHRA	Human Health Risk Assessment
IHAL	Interim Health Advisory Level
MNA	Monitored Natural Attenuation
MS/MSD	matrix spike/matrix spike duplicates
ORP	oxidation-reduction potential
OU	Operable Unit
ppb	parts per billion
RSLs	Regional Screening Levels
SLERA	Screening-Level Ecological Risk Assessment
SMC	Shieldalloy Metallurgical Corporation
TCE	trichloroethene
TDS	total dissolved solids
TOC	total organic carbon

1. INTRODUCTION

On behalf of Shieldalloy Metallurgical Corporation (SMC), Geosyntec Consultants, Inc. has prepared this Groundwater Monitoring Plan (GMP) to address Operable Unit (OU) 3 Perchlorates at the Shieldalloy Corporation Superfund Site in Newfield, New Jersey. OU3 is defined by USEPA as perchlorate contamination in soil, groundwater, and surface water and sediment in Site-associated bodies of water. This GMP was prepared in accordance with USEPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA, 1988).

1.1 Scope

Attachment A includes previously collected data that shows perchlorate concentrations in Site soil, surface water and sediment are below respective USEPA Residential Regional Screening Levels (RSLs). Consequently, the GMP focuses further monitoring on perchlorate contamination of groundwater. This GMP will be implemented after implementation of the Groundwater Investigation Work Plan (GIWP), being prepared concurrently.

The aim of this GMP is to:

- Provide adequate data to validate a remedy for OU3 groundwater, or if necessary provide additional data for selecting a remedy;
- Monitor the geochemical characteristics of the aquifer and the potential influence of these characteristics on the selected remedy for perchlorate, including monitored natural attenuation (MNA); and
- Specify the sampling frequency and analytical parameters.

1.2 Site Location and History

The Site is comprised of 67.7 acres previously devoted to manufacturing (Main Facility) and 19.8 acres of farmland (Farm Parcel) located about 2,000 feet apart. The Site is mainly located in Newfield, Gloucester County, New Jersey, though portions fall within Vineland, Cumberland County, New Jersey municipal bounds. The Site address is 35 South West Boulevard, Newfield. Figure 1 shows the Site location.

Specialty glass manufacturing began at the Main Facility in 1924. SMC purchased the facility in the early 1950s and, from 1955 to approximately 2007, manufactured items such as specialty steel and super alloy additives, primary aluminum master alloys, metal carbides, powdered metals and optical surfacing products. Current and historical use of the Farm Parcel remains agricultural.

According to information provided by SMC staff generally familiar with past operational practices, potassium perchlorate was used as an oxidizer in the on-Site furnace to increase temperature and enhance furnace performance. The furnace was located within the footprint of former Building D102(A), attached to but isolated from Building D112. Both buildings have since been demolished. Building D102(A) was characterized by an earthen floor (although the area surrounding the building is currently and was historically paved). According to historical

purchase order records, SMC purchased approximately 400,000 pounds of potassium perchlorate from 1974 to 1992 for this operational activity. Potassium perchlorate was typically packaged and shipped to the Site in 110-, 250-, and 350-pound, plastic-lined steel drums. Prior to being used in the furnace, this product was reportedly stored on Site in a former small metal outbuilding (referred to as the Former Chemical Storage Building), east of former Building D102(A) and near the unpaved road forming the northwest boundary of the storage yard slag piles. This Former Chemical Storage Building was characterized by a concrete interior floor and berm around the building's perimeter. Based on this reported information, the storage and usage of perchlorate on Site were limited to these areas, which are identified in Figure 2. Since perchlorate was completely destroyed in the heating process by reacting with aluminum to form chlorides, there was no general release from this process. Only incidentally spilled material or small amounts of incompletely reacted material were released into the environment. One possible disposition for incompletely reacted/residual perchlorate was release to a former lagoon area, also shown in Figure 2 (TRC, 2016).

1.3 Environmental Investigations and Remediation

The Site has an extensive history of soil, groundwater, sediment and surface water investigation. Environmental investigations at SMC began in 1972 to determine whether there was a relationship between the Site's operations and elevated concentrations of metals in the municipal water supply. Remedial activities that may be relevant to perchlorate investigation and remediation are summarized below (TRC, 2008) (USEPA, 2015):

- SMC installed an 80 gallons per minute (gpm) groundwater pump and treat system in 1979 to remediate chromium and trichloroethene (TCE). The groundwater was treated using ion exchange.
- SMC installed additional wells and increased extraction to 400 gpm to control off-Site migration of hexavalent chromium in 1988 and 1989.
- SMC expanded the treatment system to include an air stripper to address TCE.
- SMC switched from ion exchange to electrochemical precipitation in 1991 to address chromium concentrations in the extracted groundwater.
- SMC characterized, treated and closed nine wastewater treatment lagoons from 1994 to 1997.
- Investigation of plume geometry of various Contaminants of Concern (COCs) through vertical profiling and monitoring well installation is completed from 2002 to 2011.
- In situ remediation treatability studies began in 2010 after finding the current treatment systems were no longer efficiently treating Site COCs (concentration reduction had become asymptotic). Calcium polysulfide (CPS) was identified as an effective reagent for treating chromium-impacted groundwater. Emulsified Vegetable Oil (EVO) was found to be an effective electron donor to promote microbial degradation of TCE.
- SMC installed a new ion exchange unit in the groundwater treatment plant in 2011.

- TRC conducted an Ecological Risk Assessment and a Human Health Risk Assessment for OU3 in 2013 and 2014, respectively.

Perchlorate impacts were initially assessed during monitoring events in 2004. Concentrations in soil, surface water and sediment were reported to be below respective USEPA Residential Regional Screening Levels (RSLs). Therefore, these media were not further evaluated. Perchlorate concentrations in groundwater were above the New Jersey Class II-A Ground Water Quality Standard (GWQS) of 5 parts per billion (ppb) (TRC, 2014) (NJDEP, 2018). Data obtained for all media are included in Attachment A to this document.

Periodic groundwater sampling was conducted until 2011, when the perchlorate plume was sufficiently defined to the USEPA Interim Health Advisory Level (IHAL) of 15 ppb. Isopleths developed from the 2011 data are provided in Attachment B and show perchlorate present at concentrations above the GWQS in the shallow, intermediate and deep aquifer zones, with the plume deepening and migrating in a southwesterly direction under the influence of advective groundwater transport and a downward hydraulic gradient (TRC, 2016).

1.4 Perchlorate in the Regional Environment

Moderate perchlorate concentrations in the deep aquifer zone in wells that are located upgradient of the Site's potential perchlorate source areas suggest that there may be a regional perchlorate contamination issue unrelated to Site activities (data provided in Attachment A). The regional presence of perchlorate may have resulted from the extensive agricultural land use within the area and the potential use of Chilean-mined fertilizers (of which perchlorate is a component) on the area farms. The documentation of the presence of perchlorate in lettuce crops in Newfield and Bridgeton and spinach crops in Vineland (U.S. Food and Drug Administration, 2005) and the historical use of irrigation wells in the area provide additional evidence of the potential for a regional groundwater perchlorate issue. In 2009, drinking water quality testing conducted by the City of Vineland (which obtains its drinking water from groundwater) included perchlorate as an analyte under the Unregulated Contaminant Monitoring Rule (City of Vineland, 2009). Perchlorate was reported at concentrations ranging from 5.18 to 6 ppb in drinking water supply samples, demonstrating the regional presence of perchlorate in the groundwater (TRC, 2016).

1.5 Site Geologic, Hydrogeologic, and Hydrologic Setting

1.5.1 Geology

Three unconsolidated sedimentary units underlie the Site. From shallowest to deepest they are:

- The Bridgeton Formation - consists of up to 28 feet of brown sand and is present in the eastern portion of the Site (TRC, 2011);
- The Cohansey Sand – is the primary aquifer of concern and is comprised of coarse sands and little silt in the upper 40 feet, with generally finer sand and some clay and silt lenses in the lower 60 to 80 feet. Discontinuous silt and clay up to 6 feet in thickness is found within the lower section of the formation. The Cohansey Sand is predominantly composed of quartz, and secondary minerals include aluminum oxides and iron-containing minerals (e.g. illite and pyrite) (TRC, 2015); and

- The Kirkwood Formation – the upper portion of this unit consists of a gray silt and clay layer, and is generally encountered between 121 and 153 feet below ground surface (ft bgs).

Bedrock has not been encountered in previous Site investigations; it is estimated that the depth to bedrock beneath the Site is approximately 2,000 ft bgs (TRC, 2016).

1.5.2 Hydrogeology

The principal aquifer at the Site and surrounding area is the Cohansey Sand aquifer, which is approximately 130 feet thick. The upper portion of the Kirkwood Formation, consisting of silt and clay, functions as a confining unit by restricting the downward flow of groundwater. Groundwater flow direction in both the upper and lower Cohansey Sand is southwest toward an on-Site stream known as the Hudson Branch. Seasonal fluctuations in water table elevations are on the order of a few feet, and depth to groundwater has been measured at 4 to 27 ft bgs (TRC, 2016) (TRC, 2014).

1.6 Summary of Risk Assessments

In 2014, a Human Health Risk Assessment (HHRA) was conducted for OU3. The assessment rules out soil, surface water and sediment as posing a risk to human health. It reported that the following receptors were at risk of unacceptable perchlorate exposure through ingestion of groundwater, according to USEPA guidance:

- Future child resident exposed to on-Site shallow groundwater;
- Future adult and child resident exposed to off-Site deep groundwater;
- Future child resident exposed to Farm Parcel intermediate groundwater; and
- Future adult and child resident exposed to Farm Parcel deep groundwater.

Since the time the HHRA was completed, New Jersey has adopted a GWQS for perchlorate of 5 ppb for Class II-A groundwater. Class II-A groundwater is defined as groundwater that can be used as potable water or converted to potable water through treatment, mixing or other similar technique (NJDEP, 2018). Considering the institutional restrictions adopted for the Site, the fact that the only at-risk receptors are residents ingesting groundwater, and the fact that the GWQS was developed assuming the possibility of potable groundwater use, a remedial objective of 5 ppb will protect human receptors from unacceptable risk (TRC, 2014).

Additionally, a Screening-Level Ecological Risk Assessment (SLERA) was conducted in 2013. In accordance with USEPA guidance, the study utilized the maximum concentrations of perchlorate detected in Site soil, groundwater, surface water and sediment to conservatively calculate the concentration of perchlorate that various communities of living organisms might be exposed to, as well as the maximum daily dose that might be consumed by multiple indicator species. The study concluded that even the highest perchlorate concentrations measured on Site are unlikely to pose a risk to terrestrial or aquatic communities (TRC, 2013).

2. SCOPE OF WORK

The following tasks have been identified:

- Task 1 - Groundwater Monitoring, and;
- Task 2 - Data Management and Reporting.

The scope of work for each task is provided below.

Task 1 – Groundwater Monitoring

Groundwater will be monitored for up to eight quarters to support the remedy selection. The monitoring wells will be chosen based on the results of the initial sampling to be conducted upon approval of the GIWP and will focus on monitoring wells where perchlorate was detected. Samples will be analyzed for perchlorate. Samples in the first and last sampling rounds will also be analyzed for biogeochemical parameters that will support evaluation of MNA and Enhanced In Situ Bioremediation (EISB) remedial alternatives during the Feasibility Study (FS). Biogeochemical parameters include dissolved and total iron, nitrate, sulfate, sulfide, alkalinity, orthophosphate, total dissolved solids (TDS), total organic carbon (TOC), dissolved hydrocarbons (methane, ethane, and ethene), as well as field measurements of temperature, pH, specific conductivity, dissolved oxygen (DO), and oxidation-reduction potential (ORP). Compound specific isotope analysis samples may be collected at wells on the perimeter of the perchlorate plume depending on the results of the initial sampling round. A summary of the number of primary samples, quality control samples, associated analytical test methods, and other data quality objective information is provided on Table 1.

During each sampling event, the depth to water will be measured in each monitoring well prior to purging and sample collection. Water levels will be collected as described in the Field Sampling Plan.

Each well will be purged and sampled as described in the Field Sampling Plan and in general accordance with the USEPA Region 2 low flow sampling procedures (1998).

Quality control samples will include field duplicates and matrix spike/matrix spike duplicates (MS/MSD) at a rate of one per twenty samples. In addition, one field blank and one equipment rinsate blank will be prepared for each day that non-dedicated sampling equipment is decontaminated.

Purge water will be contained in 55-gallon drums on-Site pending receipt of analytical results, and then shipped to a licensed disposal company.

Task 2 – Data Management and Reporting

Data generated during laboratory analysis will be recorded in hard copies, electronic reports in pdf format, and in Electronic Data Deliverables (EDDs) after the samples have been analyzed. These data will then be submitted for data validation. Stage 2A validation will be performed on 25% of all samples as described in the GIWP. Where necessary, data qualifiers will be assigned to provide the basis of describing data quality. Validation qualifiers, reason codes, and comments

(as warranted) will be added to each EDD and uploaded to the project database. This information will be supplied to the project team via a validation report and to the data manager through updates to the database.

3. SCHEDULE

The groundwater monitoring schedule will be determined following completion of the initial sampling round described in the GIWP and after discussion with the USEPA.

4. REFERENCES

NJDEP. (2018). *Ground Water Quality Standards.*

TRC. (2008). *Draft Final Perchlorate Remedial Investigation Work Plan.*

TRC. (2011). *OU1 Supplemental Remedial Investigation Report.*

TRC. (2013). *Final OU3 Screening Level Ecological Risk Assessment.*

TRC. (2014). *Draft Final OU3 Human Health Risk Assessment.*

TRC. (2015). *Final Draft OU1 Feasibility Study.*

TRC. (2016). *Remedial Investigation Report.*

USEPA. (2015). *Record of Decision Amendment. Operable Unit #1 ShieldAlloy Metallurgical Corporation, Newfield, Gloucester County, New Jersey.*

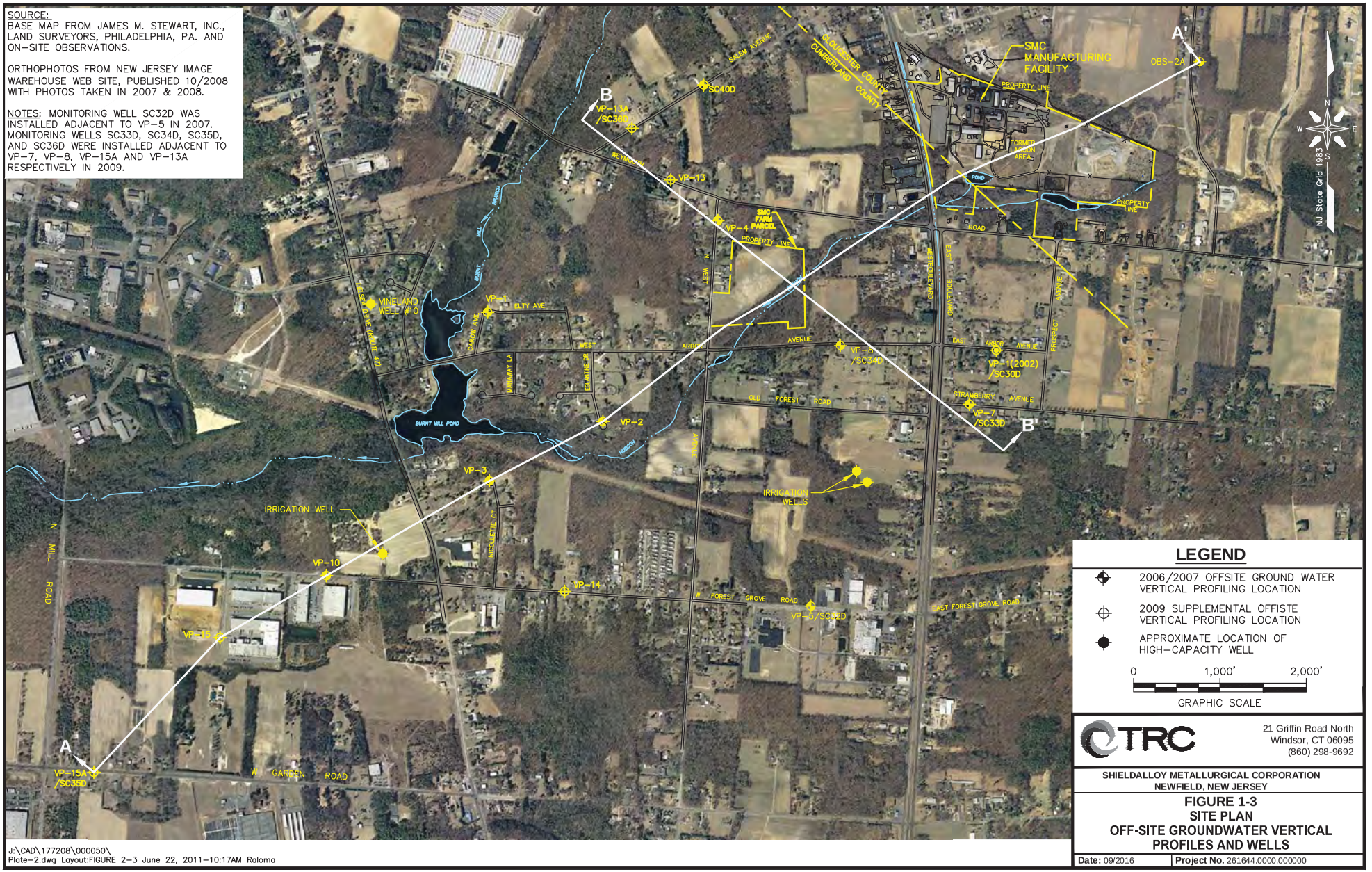
TABLE

Table 1: Sample Summary
Groundwater Monitoring Plan
Shieldalloy Metallurgical Corporation Superfund Site
Newfield, NJ

Sample Type	Sample Quantity	Analyses	Purpose of Activity
Primary Sample	30	<u>Quarterly</u> Perchlorate <u>First and Last Sampling Round</u> Total and Dissolved Iron Nitrate Sulfate Sulfide Orthophosphate Alkalinity Total Organic Carbon Total Dissolved Solids Methane, Ethane, Ethene	Further characterize the perchlorate plume. Collect additional data to be used to evaluate potential variability in groundwater biogeochemical environment(s) for use in evaluating remedial alternatives during the Feasibility Study.
Duplicate Sample	2		
Matrix Spike/Matrix Spike Duplicate	2		
Equipment Blank	1 per day		
Field Blank	1 per day		

APPENDIX A

Perchlorate Concentration Isopleths and Cross-Sections



LEGEND

- 2006/2007 OFFSITE GROUND WATER VERTICAL PROFILING LOCATION
- 2009 SUPPLEMENTAL OFFISTE VERTICAL PROFILING LOCATION
- APPROXIMATE LOCATION OF HIGH-CAPACITY WELL

0 1,000' 2,000'

GRAPHIC SCALE

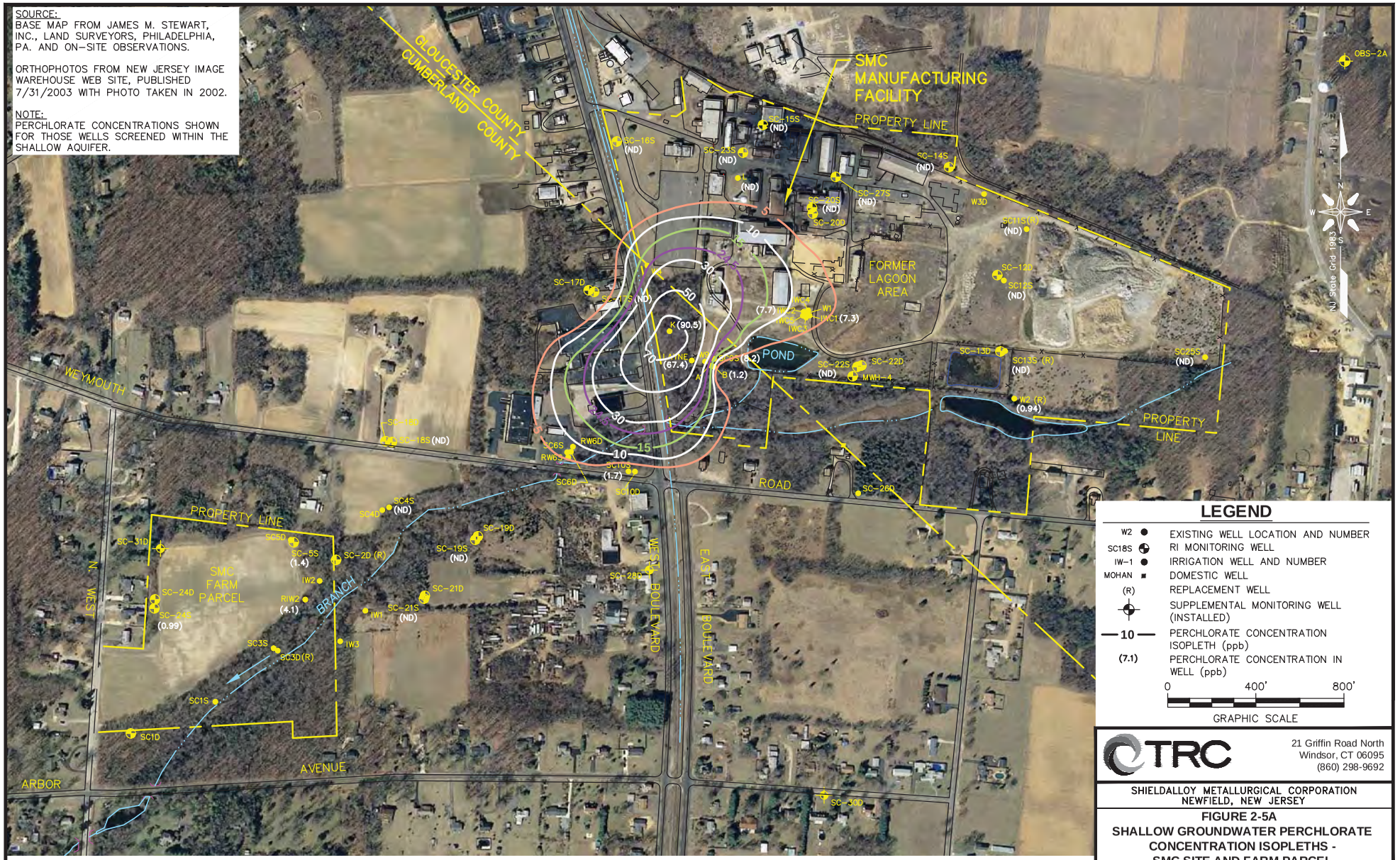
TRC
21 Griffin Road North
Windsor, CT 06095
(860) 298-9692

SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY

FIGURE 1-3
SITE PLAN
OFF-SITE GROUNDWATER VERTICAL PROFILES AND WELLS

Date: 09/2016 | **Project No.** 261644.0000.000000

J:\CAD\177208\000050\
Plate-2.dwg Layout:FIGURE 2-3 June 22, 2011-10:17AM Raloma

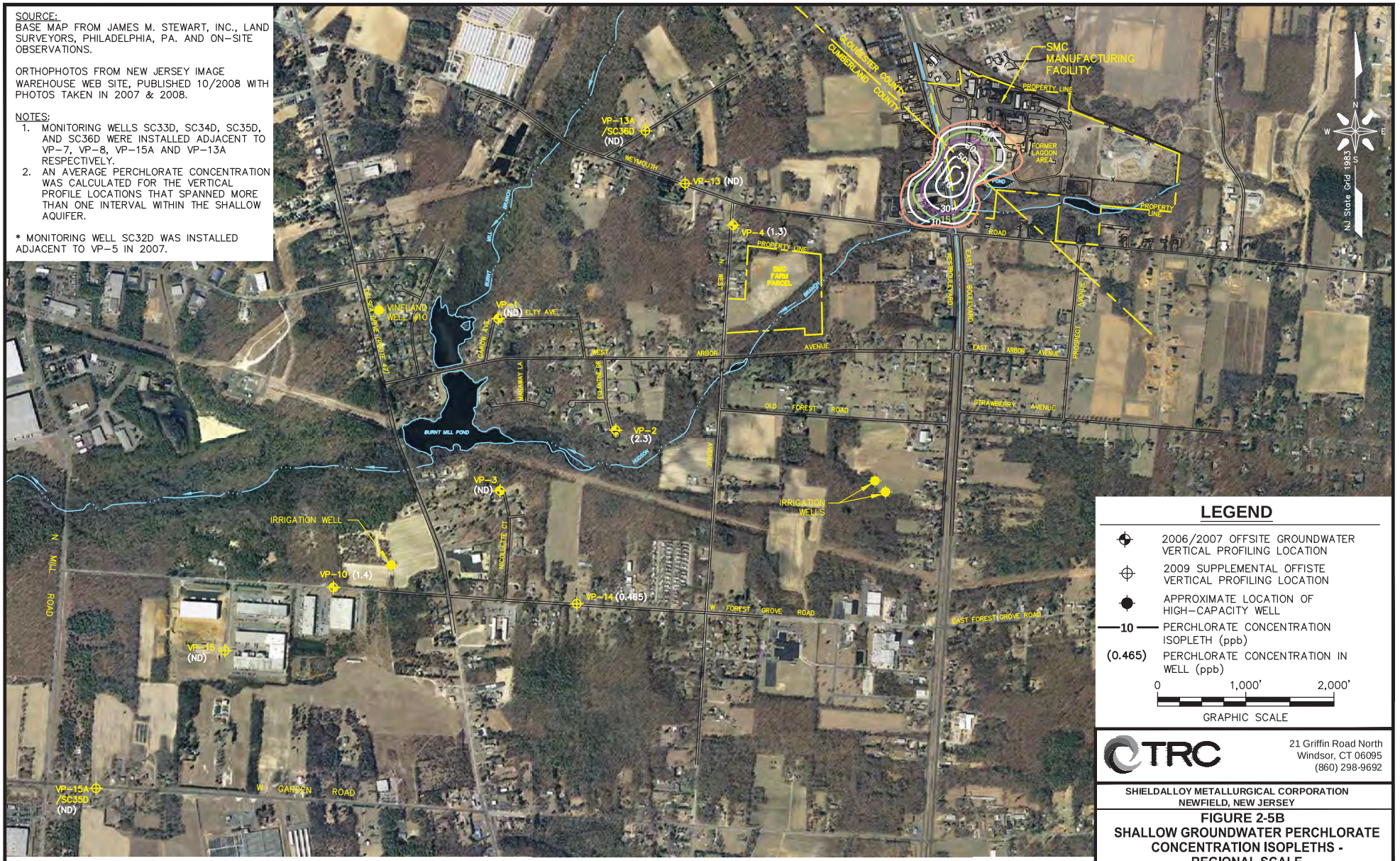

SOURCE:
BASE MAP FROM JAMES M. STEWART, INC., LAND SURVEYORS, PHILADELPHIA, PA. AND ON-SITE OBSERVATIONS.
ORTHOPHOTOS FROM NEW JERSEY IMAGE WAREHOUSE WEB SITE, PUBLISHED 7/31/2003 WITH PHOTO TAKEN IN 2002.
NOTE:
PERCHLORATE CONCENTRATIONS SHOWN FOR THOSE WELLS SCREENED WITHIN THE SHALLOW AQUIFER.
GLOUCESTER COUNTY
CUMBERLAND COUNTY
SMC MANUFACTURING FACILITY
PROPERTY LINE
FORMER LAGOON AREA
POND
WEYMOUTH
ROAD
SMC FARM PARCEL
PROPERTY LINE
N. WEST BRANCH
WEST BOULEVARD
EAST BOULEVARD
ARBOR AVENUE
SC-15S (ND)
SC-16S (ND)
SC-23S (ND)
SC-14S (ND)
SC-27S (ND)
SC-20S (ND)
SC-20D
SC-17D
SC-17S (ND)
SC-12D
SC12S (ND)
SC-13D
SC13S (R) (ND)
SC25S (ND)
SC-22S (ND)
SC-22D
MW1-4
SC-18D
SC-18S (ND)
SC6S
RW6D
RW6S
SC10S (1.7)
SC6D
SC10D
SC-26D
SC4S (ND)
SC4D
SC-19D
SC-19S (ND)
SC5D
SC-5S (1.4)
SC-2D (R)
SC-31D
SC-24D
SC-24S (0.99)
IW2
RIW2 (4.1)
IW1
SC-21D
SC-21S (ND)
SC-28D
SC3S
SC3D(R)
IW3
SC1S
SC1D
SC-30D
OBS-2A
W3D
SC15D(R) (ND)
W2 (R) (0.94)
W1
IWC1 (7.3)
IWC2
IWC3
(7.7)
K (90.5)
LINE (67.4)
B (1.2)
(3.2)
A
10
30
50
70
90
30
15
10
5
NJ State Grid 1983
N
S
E
W
LEGEND
W2 EXISTING WELL LOCATION AND NUMBER
SC18S RI MONITORING WELL
IW-1 IRRIGATION WELL AND NUMBER
MOHAN DOMESTIC WELL
(R) REPLACEMENT WELL
SUPPLEMENTAL MONITORING WELL (INSTALLED)
10 PERCHLORATE CONCENTRATION ISOPLETH (ppb)
(7.1) PERCHLORATE CONCENTRATION IN WELL (ppb)
0 400' 800'
GRAPHIC SCALE
TRC
21 Griffin Road North
Windsor, CT 06095
(860) 298-9692
SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY
FIGURE 2-5A
SHALLOW GROUNDWATER PERCHLORATE CONCENTRATION ISOPLETHS - SMC SITE AND FARM PARCEL
Date: 09/2016
Project No. 261644.0000.000000
J:\CAD\171441\000050\Remedial Inv Report\
Plate-1.dwg Layout:FIGURE 10-1A November 19, 2010-1:32PM KHollenbeck

SOURCE:
BASE MAP FROM JAMES M. STEWART, INC., LAND SURVEYORS, PHILADELPHIA, PA. AND ON-SITE OBSERVATIONS.

ORTHOPHOTOS FROM NEW JERSEY IMAGE WAREHOUSE WEB SITE, PUBLISHED 10/2008 WITH PHOTOS TAKEN IN 2007 & 2008.

NOTES:
1. MONITORING WELLS SC33D, SC34D, SC35D, AND SC36D WERE INSTALLED ADJACENT TO VP-7, VP-8, VP-15A AND VP-13A RESPECTIVELY.
2. AN AVERAGE PERCHLORATE CONCENTRATION WAS CALCULATED FOR THE VERTICAL PROFILE LOCATIONS THAT SPANNED MORE THAN ONE INTERVAL WITHIN THE SHALLOW AQUIFER.

* MONITORING WELL SC32D WAS INSTALLED ADJACENT TO VP-5 IN 2007.



LEGEND

- 2006/2007 OFFSITE GROUNDWATER VERTICAL PROFILING LOCATION
- 2009 SUPPLEMENTAL OFFISTE VERTICAL PROFILING LOCATION
- APPROXIMATE LOCATION OF HIGH-CAPACITY WELL
- 10 — PERCHLORATE CONCENTRATION ISOPLETH (ppb)
- (0.465) PERCHLORATE CONCENTRATION IN WELL (ppb)

0 1,000' 2,000'

GRAPHIC SCALE

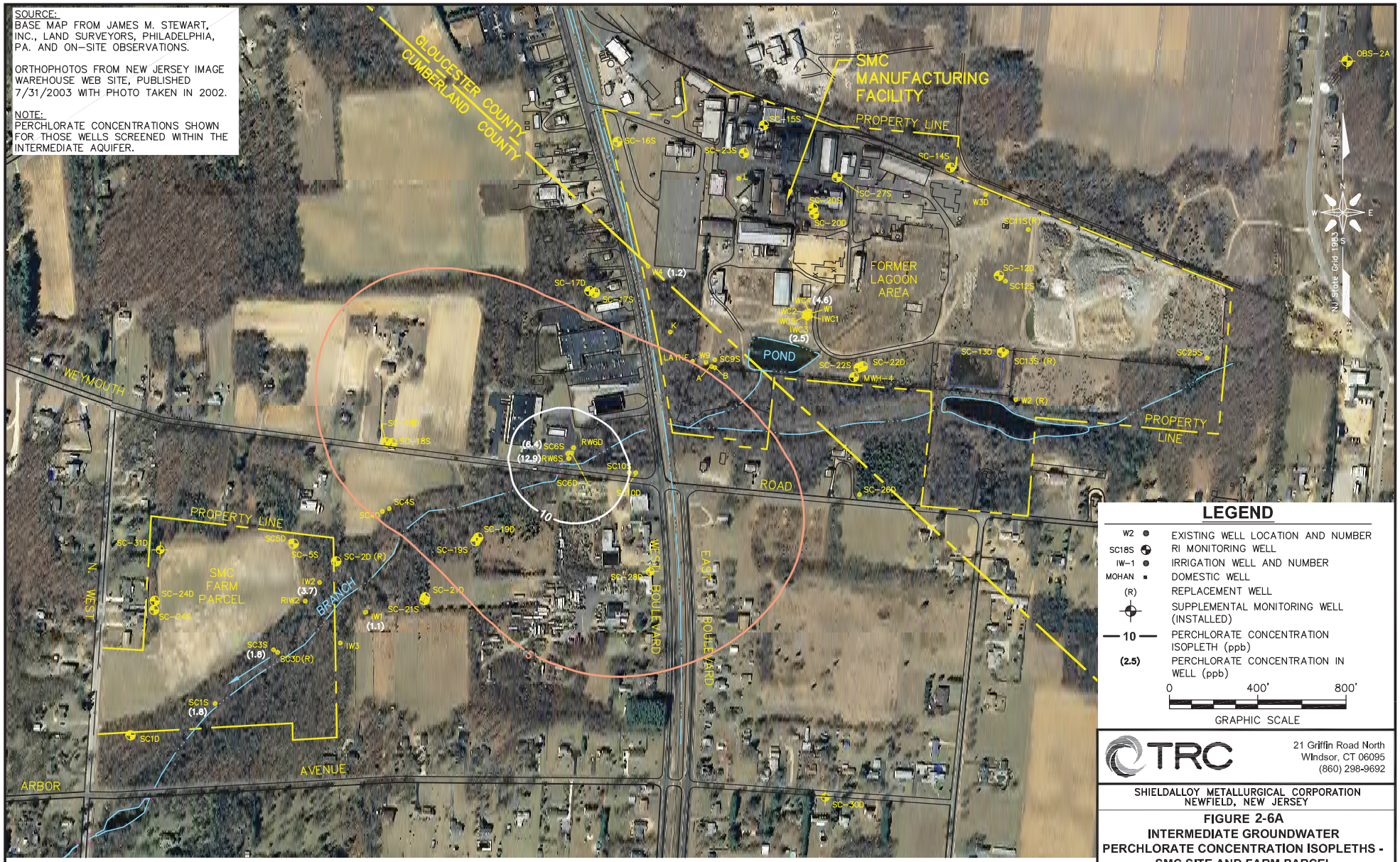
TRC
21 Griffin Road North
Windsor, CT 06095
(860) 298-9692

SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY

FIGURE 2-5B
SHALLOW GROUNDWATER PERCHLORATE CONCENTRATION ISOPLETHS - REGIONAL SCALE

Date: 09/2016 | **Project No.** 261644.0000.000000

J:\CAD\171441\000050\Remedial Inv Report\
Plate-4.dwg Layout:FIGURE 10-1B November 19, 2010-1:40PM KHollenbeck



J:\CAD\171441\000050\Remedial Inv Report\
Plate-1.dwg Layout:FIGURE 10-2A March 15, 2010-10:27AM KHollenbeck

TRC
21 Griffin Road North
Windsor, CT 06095
(860) 298-9692

SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY

FIGURE 2-6A
INTERMEDIATE GROUNDWATER PERCHLORATE CONCENTRATION ISOPLETHS - SMC SITE AND FARM PARCEL

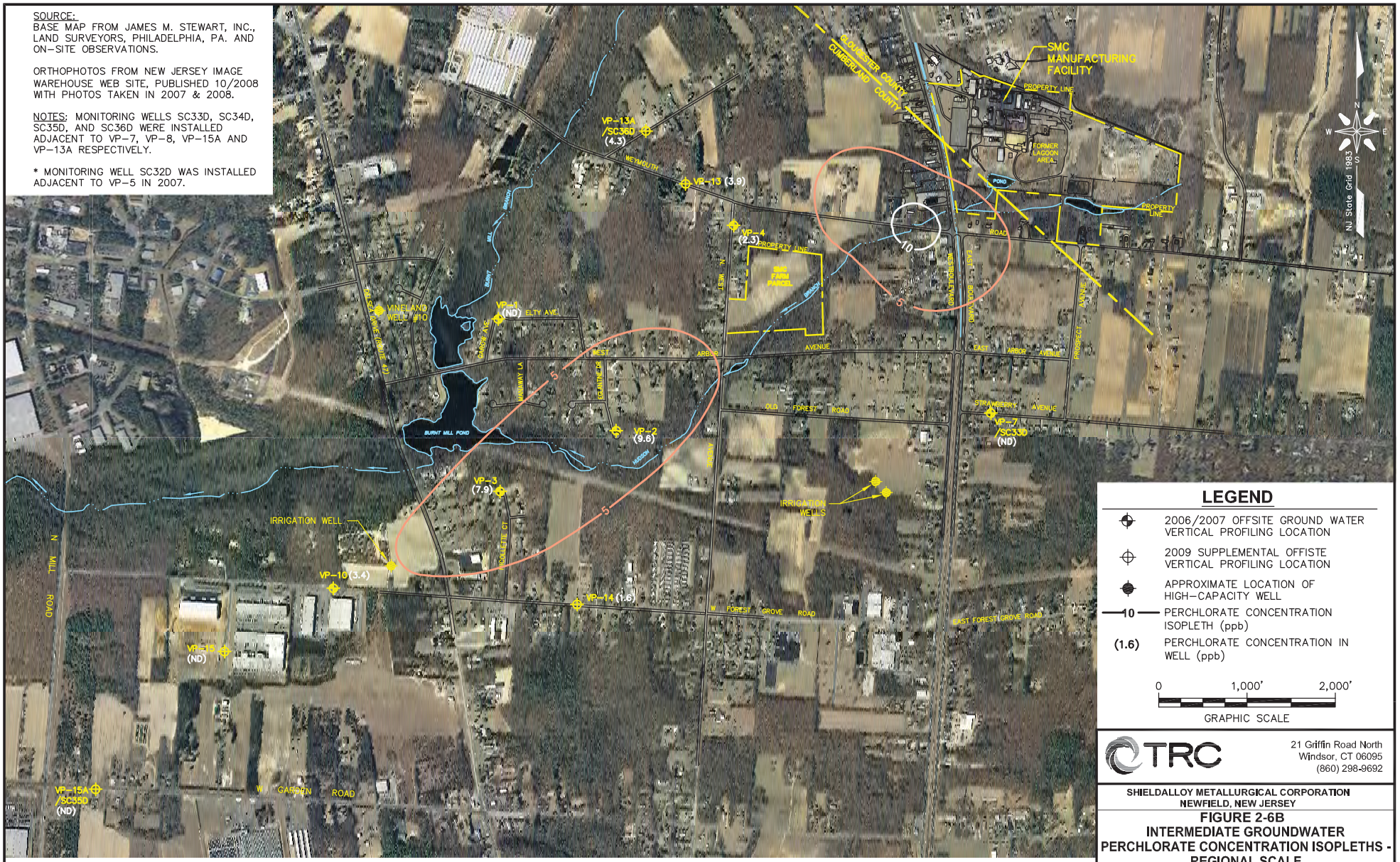
Date: 09/2016 **Project No.** 261644.0000.000000

SOURCE:
BASE MAP FROM JAMES M. STEWART, INC., LAND SURVEYORS, PHILADELPHIA, PA. AND ON-SITE OBSERVATIONS.

ORTHOPHOTOS FROM NEW JERSEY IMAGE WAREHOUSE WEB SITE, PUBLISHED 10/2008 WITH PHOTOS TAKEN IN 2007 & 2008.

NOTES: MONITORING WELLS SC33D, SC34D, SC35D, AND SC36D WERE INSTALLED ADJACENT TO VP-7, VP-8, VP-15A AND VP-13A RESPECTIVELY.

* MONITORING WELL SC32D WAS INSTALLED ADJACENT TO VP-5 IN 2007.



LEGEND

- 2006/2007 OFFSITE GROUND WATER VERTICAL PROFILING LOCATION
- 2009 SUPPLEMENTAL OFFISTE VERTICAL PROFILING LOCATION
- APPROXIMATE LOCATION OF HIGH-CAPACITY WELL
- 10 — PERCHLORATE CONCENTRATION ISOPLETH (ppb)
- (1.6) PERCHLORATE CONCENTRATION IN WELL (ppb)

0 1,000' 2,000'

GRAPHIC SCALE

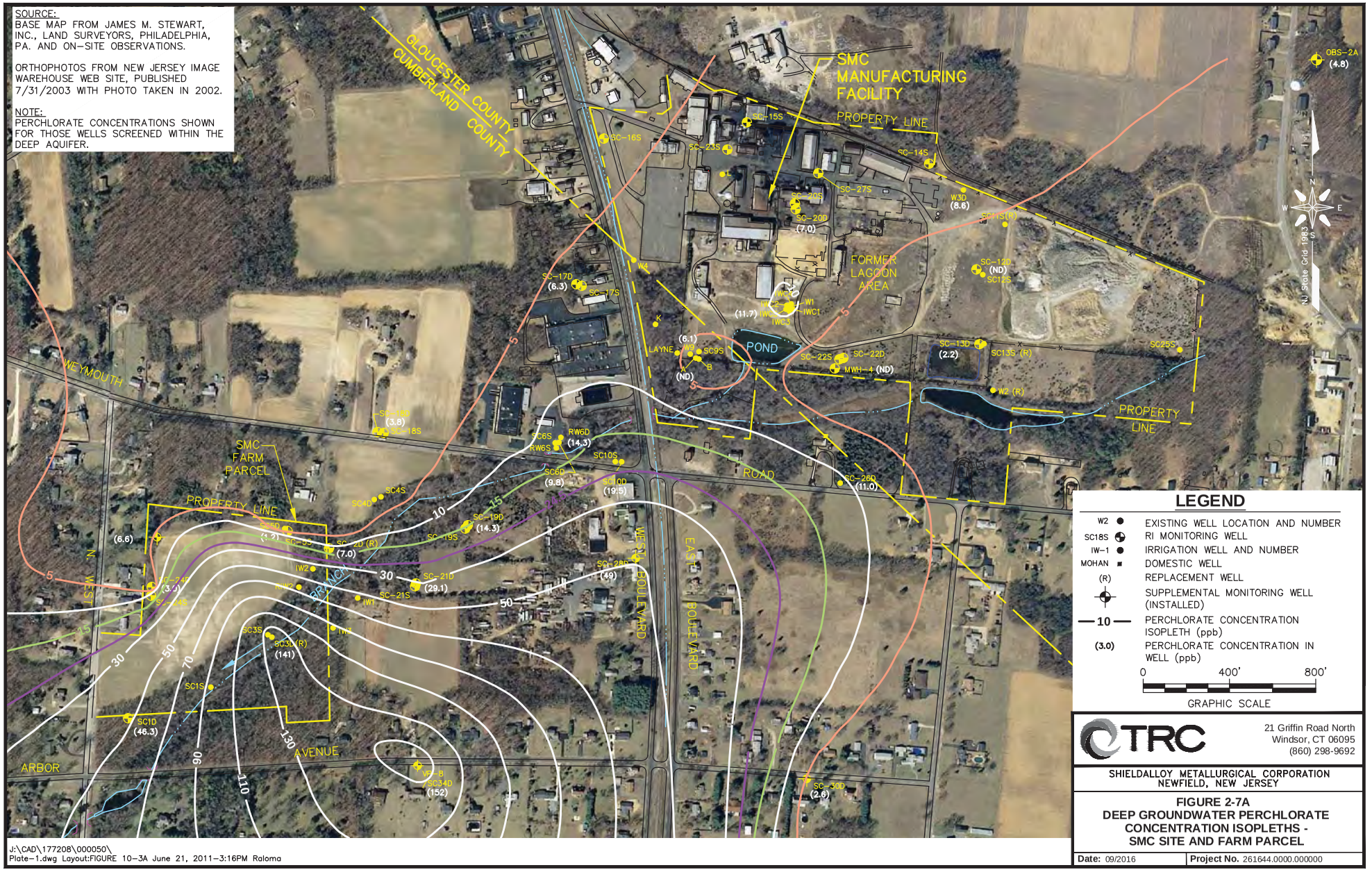
TRC
21 Griffin Road North
Windsor, CT 06095
(860) 298-9692

SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY

FIGURE 2-6B
INTERMEDIATE GROUNDWATER PERCHLORATE CONCENTRATION ISOPLETHS - REGIONAL SCALE

Date: 09/2016 | Project No. 261644.0000.000000

J:\CAD\171441\000050\Remedial Inv Report\
Plate-4.dwg Layout:FIGURE 10-2B March 15, 2010-10:15AM KHollenbeck

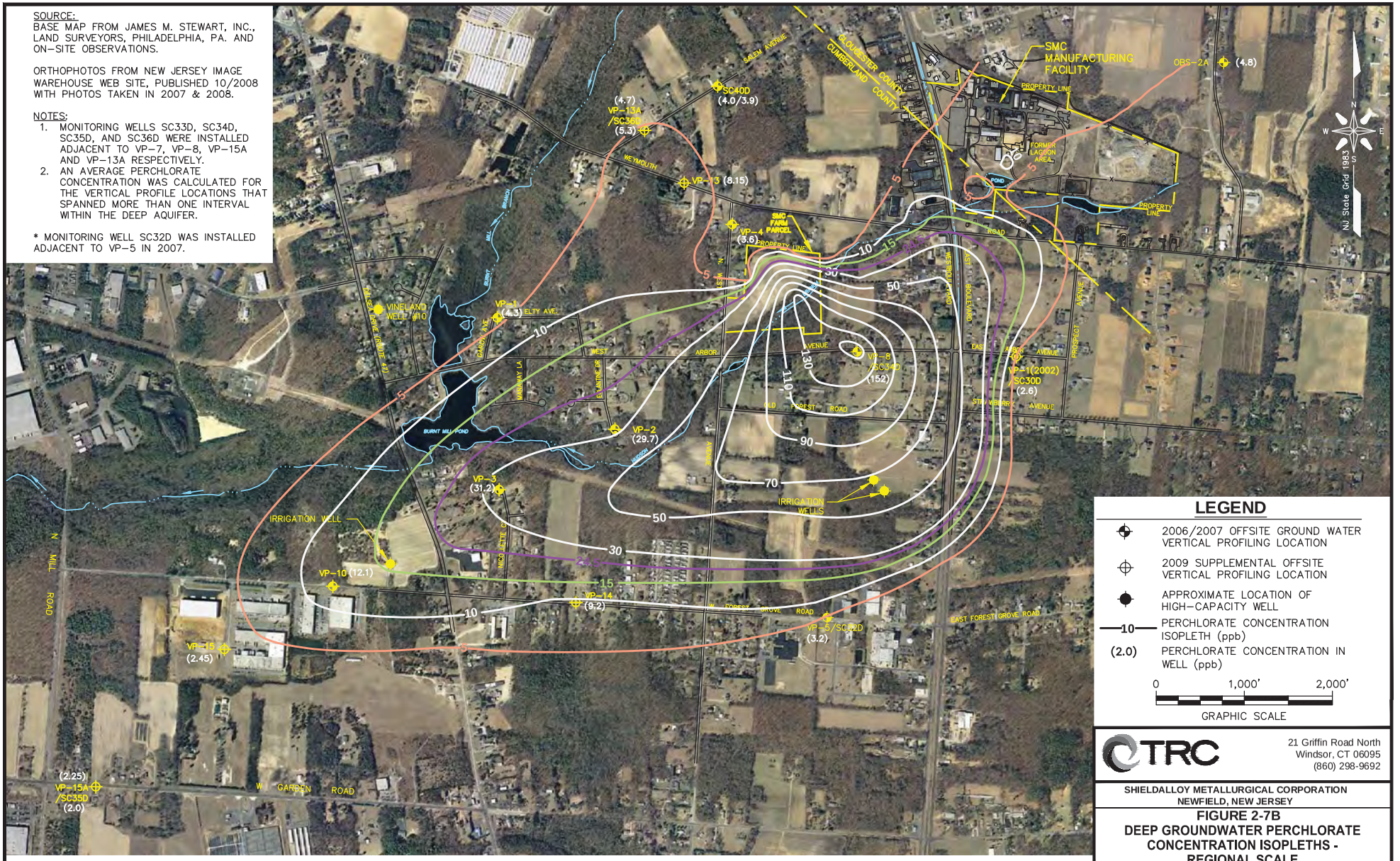

SOURCE:
BASE MAP FROM JAMES M. STEWART, INC., LAND SURVEYORS, PHILADELPHIA, PA. AND ON-SITE OBSERVATIONS.
ORTHOPHOTOS FROM NEW JERSEY IMAGE WAREHOUSE WEB SITE, PUBLISHED 7/31/2003 WITH PHOTO TAKEN IN 2002.
NOTE:
PERCHLORATE CONCENTRATIONS SHOWN FOR THOSE WELLS SCREENED WITHIN THE DEEP AQUIFER.
GLOUCESTER COUNTY
CUMBERLAND COUNTY
SMC MANUFACTURING FACILITY
PROPERTY LINE
FORMER LAGOON AREA
POND
WEYMOUTH
SMC FARM PARCEL
PROPERTY LINE
ROAD
WEST BRANCH
WEST BOULEVARD
EAST BOULEVARD
ARBOR AVENUE
N
W
E
S
NJ State Grid 1983
LEGEND
W2 EXISTING WELL LOCATION AND NUMBER
SC18S RI MONITORING WELL
IW-1 IRRIGATION WELL AND NUMBER
MOHAN DOMESTIC WELL
(R) REPLACEMENT WELL
SUPPLEMENTAL MONITORING WELL (INSTALLED)
10 PERCHLORATE CONCENTRATION ISOPLETH (ppb)
(3.0) PERCHLORATE CONCENTRATION IN WELL (ppb)
0 400' 800'
GRAPHIC SCALE
TRC
21 Griffin Road North
Windsor, CT 06095
(860) 298-9692
SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY
FIGURE 2-7A
DEEP GROUNDWATER PERCHLORATE CONCENTRATION ISOPLETHS -
SMC SITE AND FARM PARCEL
Date: 09/2016
Project No. 261644.0000.000000
J:\CAD\177208\000050\
Plate-1.dwg Layout:FIGURE 10-3A June 21, 2011-3:16PM Raloma

SOURCE:
BASE MAP FROM JAMES M. STEWART, INC., LAND SURVEYORS, PHILADELPHIA, PA. AND ON-SITE OBSERVATIONS.

ORTHOPHOTOS FROM NEW JERSEY IMAGE WAREHOUSE WEB SITE, PUBLISHED 10/2008 WITH PHOTOS TAKEN IN 2007 & 2008.

NOTES:
1. MONITORING WELLS SC33D, SC34D, SC35D, AND SC36D WERE INSTALLED ADJACENT TO VP-7, VP-8, VP-15A AND VP-13A RESPECTIVELY.
2. AN AVERAGE PERCHLORATE CONCENTRATION WAS CALCULATED FOR THE VERTICAL PROFILE LOCATIONS THAT SPANNED MORE THAN ONE INTERVAL WITHIN THE DEEP AQUIFER.

* MONITORING WELL SC32D WAS INSTALLED ADJACENT TO VP-5 IN 2007.



LEGEND

- 2006/2007 OFFSITE GROUND WATER VERTICAL PROFILING LOCATION
- 2009 SUPPLEMENTAL OFFSITE VERTICAL PROFILING LOCATION
- APPROXIMATE LOCATION OF HIGH-CAPACITY WELL
- 10 — PERCHLORATE CONCENTRATION ISOPLETH (ppb)
- (2.0) PERCHLORATE CONCENTRATION IN WELL (ppb)

0 1,000' 2,000'
GRAPHIC SCALE

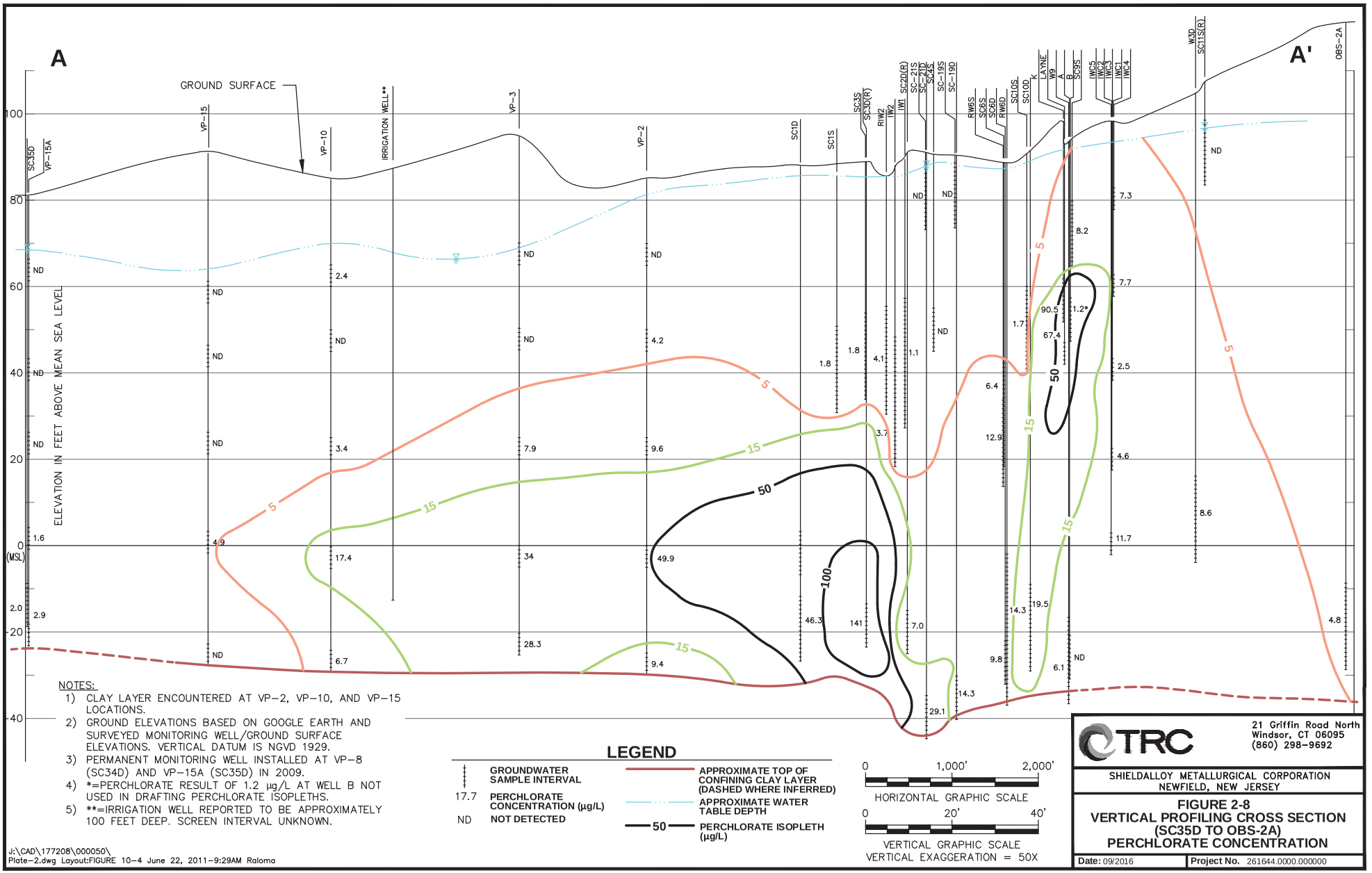
TRC
21 Griffin Road North
Windsor, CT 06095
(860) 298-9692

SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY

FIGURE 2-7B
DEEP GROUNDWATER PERCHLORATE CONCENTRATION ISOPLETHS - REGIONAL SCALE

Date: 09/2016 | **Project No.** 261644.0000.000000

J:\CAD\177208\000050\
Plate-2.dwg Layout:FIGURE 10-3B June 21, 2011-3:18PM Raloma



NOTES:

1) CLAY LAYER ENCOUNTERED AT VP-2, VP-10, AND VP-15 LOCATIONS.
2) GROUND ELEVATIONS BASED ON GOOGLE EARTH AND SURVEYED MONITORING WELL/GROUND SURFACE ELEVATIONS. VERTICAL DATUM IS NGVD 1929.
3) PERMANENT MONITORING WELL INSTALLED AT VP-8 (SC34D) AND VP-15A (SC35D) IN 2009.
4) *=PERCHLORATE RESULT OF 1.2 µg/L AT WELL B NOT USED IN DRAFTING PERCHLORATE ISOPLETHS.
5) **=IRRIGATION WELL REPORTED TO BE APPROXIMATELY 100 FEET DEEP. SCREEN INTERVAL UNKNOWN.

LEGEND

- GROUNDWATER SAMPLE INTERVAL
- 17.7 PERCHLORATE CONCENTRATION (µg/L)
- ND NOT DETECTED
- APPROXIMATE TOP OF CONFINING CLAY LAYER (DASHED WHERE INFERRED)
- APPROXIMATE WATER TABLE DEPTH
- 50 PERCHLORATE ISOPLETH (µg/L)

0 1,000' 2,000'
HORIZONTAL GRAPHIC SCALE

0 20' 40'
VERTICAL GRAPHIC SCALE
VERTICAL EXAGGERATION = 50X

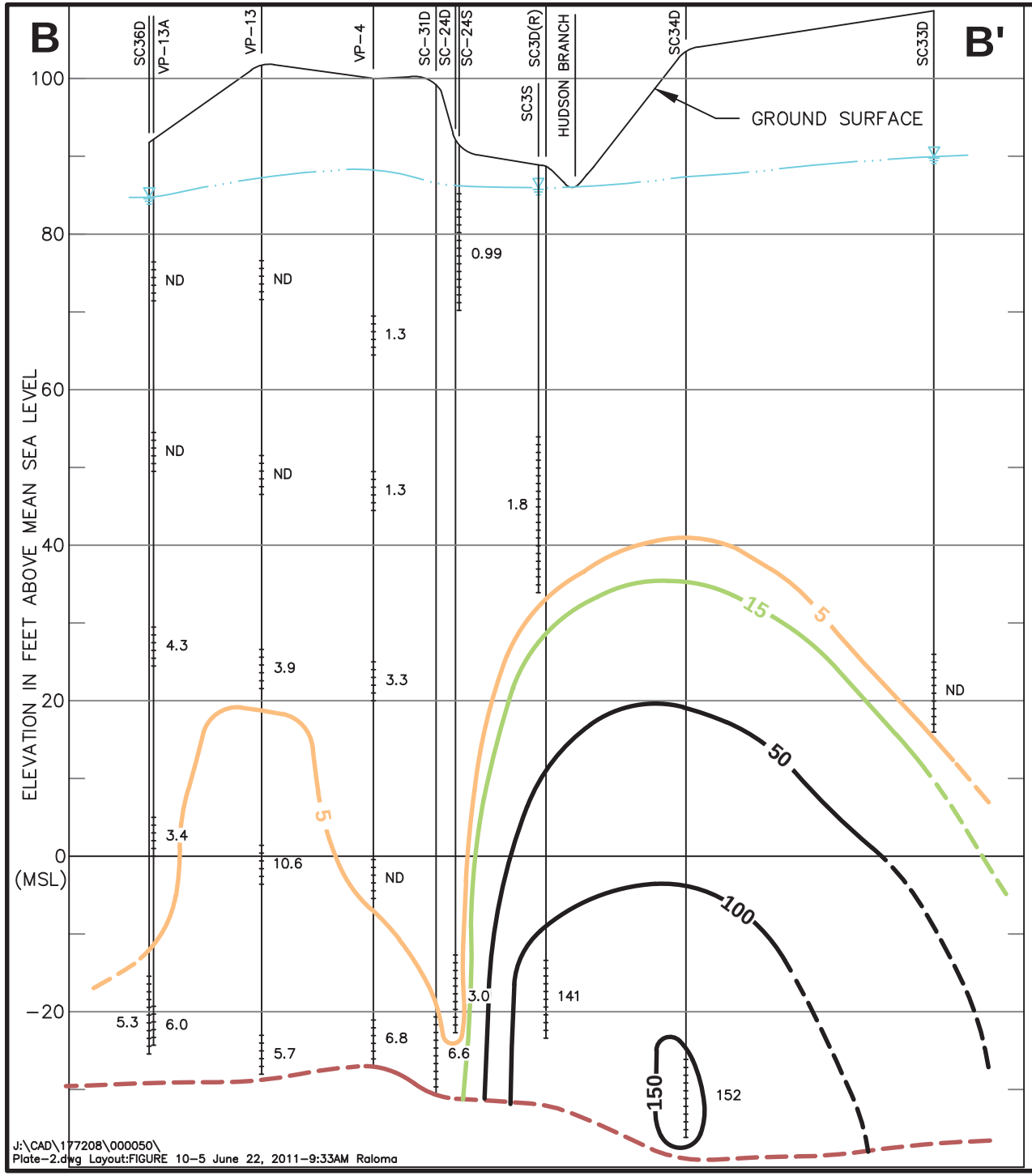
TRC
21 Griffin Road North
Windsor, CT 06095
(860) 298-9692

SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY

FIGURE 2-8
VERTICAL PROFILING CROSS SECTION (SC35D TO OBS-2A) PERCHLORATE CONCENTRATION

Date: 09/2016 | Project No. 261644.0000.000000

J:\CAD\177208\000050\
Plate-2.dwg Layout:FIGURE 10-4 June 22, 2011-9:29AM Raloma



LEGEND

- APPROXIMATE TOP OF CONFINING CLAY LAYER (DASHED WHERE INFERRED)
- APPROXIMATE WATER TABLE DEPTH
- 50 — PERCHLORATE ISOPLETH (µg/L) (DASHED WHERE INFERRED)
- GROUNDWATER SAMPLE INTERVAL
- 17.7 — PERCHLORATE CONCENTRATION (µg/L)
- ND — NOT DETECTED

NOTES:

1) CLAY LAYER ENCOUNTERED AT VP-4 AND SC31D LOCATIONS.
2) GROUND ELEVATIONS BASED ON GOOGLE EARTH AND SURVEYED MONITORING WELL/GROUND SURFACE ELEVATIONS. VERTICAL DATUM IS NGVD 1929.
3) PERMANENT MONITORING WELLS INSTALLED AT VP-7 (SC33D) AND VP-8 (SC34D) IN 2009.

0 1,000' 2,000'

HORIZONTAL GRAPHIC SCALE

0 20' 40'

VERTICAL GRAPHIC SCALE
VERTICAL EXAGGERATION = 50X

TRC
21 Griffin Road North
Windsor, CT 06095
(860) 298-9692

SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY

FIGURE 2-9
VERTICAL PROFILING CROSS SECTION (SC36D TO SC33D) PERCHLORATE CONCENTRATION

Date: 09/2016 | **Project No.** 261644.0000.000000

J:\CAD\177208\000050\Plate-2.dwg Layout:FIGURE 10-5 June 22, 2011-9:33AM Raloma

ATTACHMENT A

Previous Perchlorate Analytical Results

TABLE 2-1
Groundwater Perchlorate Results Summary - 2004 Through 2011
Perchlorate Remedial Investigation
Shieldalloy Metallurgical Corporation
Newfield, New Jersey

WELL IDENTIFIER	SCREENED INTERVAL (FTBGS)[1]	RELATIVE AQUIFER DEPTH	PERCHLORATE (µg/L) SAMPLING EVENT							
			JULY 27, 2004	SEPTEMBER 10, 2004	SEPTEMBER 30, 2004	OCTOBER 27, 2004	FEBRUARY 21, 2006	OCTOBER 20-22, 2009[2]	SEPTEMBER 8-9, 2010	APRIL 29, 2011
ON-SITE MONITORING WELLS										
IWC-1	15-20	Shallow	**9.9**	**10.0**	NA	NA	NA	**7.3**	NA	NA
IWC-2	35-40	Shallow	**10**	**9.4**	NA	NA	NA	**7.7**	NA	NA
IWC-3	55-60	Intermediate	4.0 / 4.1	4.0 / 4.0	NA	NA	NA	2.5 J [3]	NA	NA
IWC-4	75-80	Intermediate	**5.4**	**6.9**	NA	NA	NA	4.6	4.4	NA
IWC-5	95-100	Deep	**10.0**	**11.0**	NA	NA	NA	**11.7 / 10.7**[4]	NA	NA
A	114-124	Deep	NA	<0.18	NA	NA	NA	<3.0	NA	NA
B	36-46	Shallow	NA	**8.0**	NA	NA	NA	1.2 J [3]	NA	NA
K	36-46	Shallow	NA	NA	NA	NA	NA	**90.5 / 78.1**	1.9 J[6] / 3.0	NA
L	42-52	Shallow	NA	NA	NA	NA	NA	<3.0	NA	NA
SC9S	15-30	Shallow	NA	**8.0**	NA	NA	NA	**8.2 / 8.0**[5]	NA	NA
SC11S(R)	9-24	Shallow	NA	NA	NA	NA	NA	<3.0	<3.0	NA
SC12S	15-25	Shallow	NA	NA	NA	NA	NA	<3.0	NA	NA
SC12D	126-136	Deep	NA	NA	NA	NA	NA	<3.0	<3.0	NA
SC13S(R)	14.7-24.7	Shallow	NA	NA	NA	NA	NA	<3.0	NA	NA
SC13D	127-137	Deep	NA	NA	NA	NA	NA	2.2 J [6]	NA	NA
SC14S	12-27	Shallow	NA	0.21 J	NA	NA	NA	<3.0	<3.0	NA
SC15S	12.5-27.5	Shallow	NA	NA	NA	NA	NA	<3.0	NA	NA
SC16S	12-27	Shallow	NA	NA	NA	NA	NA	<3.0	<3.0	NA
SC20S	7-22	Shallow	NA	NA	NA	NA	NA	<3.0	NA	NA
SC20D	129-139	Deep	NA	NA	NA	NA	NA	**7.0**	**6.0**	NA
SC22S	3-18	Shallow	NA	NA	NA	NA	NA	<3.0	2.0 J[6]	NA
SC23S	9-24	Shallow	NA	NA	NA	NA	NA	<3.0	NA	NA
SC25S	7-22	Shallow	NA	NA	NA	NA	NA	<3.0	0.64 J[6]	NA
SC27S	7-22	Shallow	NA	NA	NA	NA	NA	<3.0	NA	NA
MWH-4	119-129	Deep	NA	NA	NA	NA	NA	<3.0	NA	NA
W2(R)	2-17	Shallow	NA	NA	NA	NA	NA	0.94 J [6]	<3.0	NA
W3D	88-108	Deep	NA	NA	NA	NA	NA	**8.6**	**7.4**	NA
W4	55-75	Intermediate	NA	NA	NA	NA	NA	1.2 J[6]	0.93 J[6]	NA

NOTES:

(1) - FTBGS, Feet Below Ground Surface
(2) - Monitoring wells SC33D & SC34D were sampled on 11/19/09, monitoring wells SC35D & SC36D were sampled on 12/7/09, monitoring well K was re-sampled on 1/21/10, & recovery wells Layne & W9 were sampled on 1/21/10
(3) - Data qualifier changed to "J" by data validation
(4) - "Blind" duplicate sample labeled as IWC-6
(5) - "Blind" duplicate sample labeled as SC33S
(6) - Data not validated, but qualifier changed to "J" consistent with data validation
(7) - Data validation corrected reporting limit
(8) - "Blind" duplicate sample labeled as SC35D
(9) - "Blind" duplicate sample labeled as SC37D
(10) - "Blind" duplicate sample labeled as SC34D

µg/L - micrograms per liter
NA - Not Analyzed
All samples were analyzed by EPA Method 314.0
BOLD - indicates that value is greater than the perchlorate action level of 5 µg/L (2006 ACO)
Shaded - Indicates that value is greater than the EPA Interim Health Advisory Level of 15 µg/L
J - Indicates a result is less than the reporting limit and estimated by the laboratory
Results with slash (e.g., 13.0 / 12.9) indicate duplicate results

TABLE 2-1
Groundwater Perchlorate Results Summary - 2004 Through 2011
Perchlorate Remedial Investigation
Shieldalloy Metallurgical Corporation
Newfield, New Jersey

WELL IDENTIFIER	SCREENED INTERVAL (FTBGS)[1]	RELATIVE AQUIFER DEPTH	PERCHLORATE (µg/L) SAMPLING EVENT							
			JULY 27, 2004	SEPTEMBER 10, 2004	SEPTEMBER 30, 2004	OCTOBER 27, 2004	FEBRUARY 21, 2006	OCTOBER 20-22, 2009[2]	SEPTEMBER 8-9, 2010	APRIL 29, 2011
OFF-SITE MONITORING WELLS										
OBS-2A	129-149	Deep	NA	NA	NA	NA	NA	4.8 J [6]	NA	NA
IW1	32-62	Intermediate	NA	NA	NA	NA	NA	1.1 J [6]	NA	NA
SC4S	35-45	Shallow	NA	NA	1.1	NA	NA	<3.0	NA	NA
SC6S	45-75	Intermediate	NA	NA	1.6	NA	NA	**6.4**	**19.6**	NA
SC6D	110-120	Deep	NA	NA	3.5	NA	NA	**9.8**	NA	NA
SC10S	35-55	Shallow	NA	NA	NA	NA	NA	1.7 J [6]	<3.0	NA
SC10D	105-125	Deep	NA	NA	NA	NA	NA	**19.5**	**8.5**	NA
SC17S	19-28	Shallow	NA	NA	NA	NA	NA	<3.0	<3.0	NA
SC17D	143-153	Deep	NA	NA	NA	NA	NA	**6.3**	**5.6**	NA
SC18S	4-19	Shallow	NA	NA	NA	NA	NA	<15.0 [7]	<3.0	NA
SC18D	119-129	Deep	NA	NA	NA	NA	NA	3.8	NA	NA
SC19S	2-17	Shallow	NA	NA	NA	NA	NA	<3.0	NA	NA
SC19D	120-130	Deep	NA	NA	NA	NA	NA	**14.3**	NA	NA
SC21S	3-18	Shallow	NA	NA	NA	NA	NA	<3.0	<3.0	NA
SC21D	125-135	Deep	NA	NA	NA	NA	NA	**29.1**	**32.8**	NA
SC26D	127-137	Deep	NA	NA	NA	NA	NA	**11.0**	**6.8**	NA
SC28D	133-153	Deep	NA	NA	NA	**34.0**	NA	**49.0**	**16.8**	NA
SC30D	147-157	Deep	NA	NA	NA	1.9	NA	2.6 J [6]	2.8 J[6]	NA
SC32D	92-102	Deep	NA	NA	NA	NA	NA	3.2 / 3.3[8]	3.7	NA
SC33D	82.5-92.5	Intermediate	NA	NA	NA	NA	NA	<3.0	<3.0	NA
SC34D	130-140	Deep	NA	NA	NA	NA	NA	**150 / 152[9]**	**158**	NA
SC35D	89.5-99.5	Deep	NA	NA	NA	NA	NA	2.0 J [6]	2.7 J[6]	NA
SC36D	107-117	Deep	NA	NA	NA	NA	NA	**5.3**	**6.4 / 5.6[9]**	NA
SC40D	120-130	Deep	NA	NA	NA	NA	NA	NA	NA	4.0 / 3.9 [11]
ON-SITE EXTRACTION WELLS										
Layne	42-47	Shallow	NA	**23.0**	NA	NA	NA	**67.4**	**36.6**	NA
W9	110-130	Deep	NA	**10.0**	NA	NA	NA	**6.1**	NA	NA

NOTES:

(1) - FTBGS, Feet Below Ground Surface
(2) - Monitoring wells SC33D & SC34D were sampled on 11/19/09, monitoring wells SC35D & SC36D were sampled on 12/7/09, monitoring well K was re-sampled on 1/21/10, & recovery wells Layne & W9 were sampled on 1/21/10
(3) - Data qualifier changed to "J" by data validation
(4) - "Blind" duplicate sample labeled as IWC-6
(5) - "Blind" duplicate sample labeled as SC33S
(6) - Data not validated, but qualifier changed to "J" consistent with data validation
(7) - Data validation corrected reporting limit
(8) - "Blind" duplicate sample labeled as SC35D
(9) - "Blind" duplicate sample labeled as SC37D
(10) - "Blind" duplicate sample labeled as SC34D
(11) - "Blind" duplicate sample labeled as SC49D

µg/L - micrograms per liter
NA - Not Analyzed
All samples were analyzed by EPA Method 314.0
BOLD - indicates that value is greater than the perchlorate action level of 5 µg/L (2006 ACO)
Shaded - Indicates that value is greater than the EPA Interim Health Advisory Level of 15 µg/L
J - Indicates a result is less than the reporting limit and estimated by the laboratory
Results with slash (e.g., 13.0 / 12.9) indicate duplicate results

TABLE 2-1
Groundwater Perchlorate Results Summary - 2004 Through 2011
Perchlorate Remedial Investigation
Shieldalloy Metallurgical Corporation
Newfield, New Jersey

WELL IDENTIFIER	SCREENED INTERVAL (FTBGS)[1]	RELATIVE AQUIFER DEPTH	PERCHLORATE (µg/L) SAMPLING EVENT							
			JULY 27, 2004	SEPTEMBER 10, 2004	SEPTEMBER 30, 2004	OCTOBER 27, 2004	FEBRUARY 21, 2006	OCTOBER 20-22, 2009[2]	SEPTEMBER 8-9, 2010	APRIL 29, 2011
FARM PARCEL MONITORING WELLS										
IW2	40-70	Intermediate	NA	NA	NA	NA	NA	3.7	NA	NA
SC1S	35-55	Intermediate	NA	NA	NA	3.5	**8.8**	1.8 J [3]	0.69 J[3]	NA
SC1D	85-95/100-115	Deep	NA	NA	NA	**76.0 / 76.0**	**53.9**	**46.3**	**44.5**	NA
SD2D(R)	106-116	Deep	NA	NA	**9.2**	NA	NA	**7.0**	**6.6**	NA
SC3S	35-55	Intermediate	NA	NA	**13**	NA	**20.9**	1.8 J [3]	**13.0**	NA
SC3D(R)	102-112	Deep	NA	NA	**49**	NA	**62.1**	**141 / 136[10]**	**143**	NA
SC5S	5-20	Shallow	NA	NA	NA	NA	NA	1.4 J [6]	NA	NA
SC5D	90-120	Deep	NA	NA	NA	NA	NA	1.2 J [6]	NA	NA
SC24S	5-20	Shallow	NA	NA	NA	4.8	4.3	0.99 J [6]	2.1 J[3]	NA
SC24D	105-115	Deep	NA	NA	NA	**6**	3.0	3.0	NA	NA
SC31D	120-130	Deep	NA	NA	NA	NA	NA	**6.6**	NA	NA
OFFSITE EXTRACTION WELLS										
RIW2	30-55	Shallow	NA	NA	**14.0 / 15.1**	NA	**9.4**	4.1	NA	NA
RW6S	55-75	Intermediate	NA	NA	**8.0 / 8.01**	NA	NA	**12.9**	NA	NA
RW6D	90-125	Deep	NA	NA	**12.0 / 13.8**	NA	NA	**14.3**	NA	NA

NOTES:

(1) - FTBGS, Feet Below Ground Surface
(2) - Monitoring wells SC33D & SC34D were sampled on 11/19/09, monitoring wells SC35D & SC36D were sampled on 12/7/09, monitoring well K was re-sampled on 1/21/10, & recovery wells Layne & W9 were sampled on 1/21/10
(3) - Data qualifier changed to "J" by data validation
(4) - "Blind" duplicate sample labeled as IWC-6
(5) - "Blind" duplicate sample labeled as SC33S
(6) - Data not validated, but qualifier changed to "J" consistent with data validation
(7) - Data validation corrected reporting limit
(8) - "Blind" duplicate sample labeled as SC35D
(9) - "Blind" duplicate sample labeled as SC37D
(10) - "Blind" duplicate sample labeled as SC34D

µg/L - micrograms per liter
NA - Not Analyzed / Not Applicable
All samples were analyzed by EPA Method 314.0
BOLD - indicates that value is greater than the perchlorate action level of 5 µg/L (2006 ACO)
Shaded - Indicates that value is greater than the EPA Interim Health Advisory Level of 15 µg/L
J - Indicates a result is less than the reporting limit and estimated by the laboratory
Results with slash (e.g., 13.0 / 12.9) indicate duplicate results

TABLE 2-2
Current and Previous Off-Site Groundwater Vertical Profiling Perchlorate Results
Perchlorate Remedial Investigation
Shieldalloy Metallurgical Corporation
Newfield, New Jersey

Sample ID	Date Sampled	Approx. Ground Surface Elevation (ftmsl)	Sample Depth (ftbgs)	Approx. Sample Elevation (ftmsl)	Relative Aquifer Depth	Perchlorate (ug/L)
Vertical Profile Samples (2009 Investigation)						
VP-13 (25-30)	10/14/2009	102	25-30	77 to 72	Shallow	<3.0
VP-13 (50-55)	10/14/2009	102	50-55	52 to 47	Shallow	<3.0
VP-13 (75-80)	10/14/2009	102	75-80	27 to 22	Intermediate	3.9
VP-13 (100-105)	10/15/2009	102	100-105	2 to -3	Deep	**10.6**
VP-13 (125-130)	10/15/2009	102	125-130	-23 to -28	Deep	**5.7**
VP-13A (15-20)	10/22/2009	89	15-20	74 to 69	Shallow	<3.0
VP-13A (37-42)	10/22/2009	89	37-42	52 to 47	Shallow	<3.0
VP-13A (62-67)	10/22/2009	89	62-67	27 to 22	Intermediate	4.3
VP-13A (87-92)	10/23/2009	89	87-92	2 to -3	Deep	3.4
VP-13A (111-116)	10/23/2009	89	111-116	-22 to -27	Deep	**6.0**
VP-14 (35-40)	10/16/2009	100	35-40	65 to 60	Shallow	0.93 J (2)
VP-14 (55-60)	10/16/2009	100	55-60	45 to 40	Shallow	<3.0
VP-14 (80-85)	10/19/2009	100	80-85	20 to 15	Intermediate	1.6 J (1)
VP-14 (105-110)	10/19/2009	100	105-110	-5 to -10	Deep	**6.2**
VP-24 (105-110) Field Dup	10/19/2009	100	105-110	-5 to -10	Deep	**5.9**
VP-14 (130-135)	10/19/2009	100	130-135	-30 to -35	Deep	**12.5**
VP-15 (30-35)	10/12/2009	91	30-35	61 to 56	Shallow	<3.0
VP-15 (45-50)	10/12/2009	91	45-50	46 to 41	Shallow	<3.0
VP-15 (65-70)	10/13/2009	91	65-70	26 to 21	Intermediate	<3.0
VP-15 (88-93)	10/13/2009	91	88-93	3 to -2	Deep	4.9
VP-15 (114-119)	10/13/2009	91	114-119	-23 to -28	Deep	<3.0
VP-15A (15-20)	10/20/2009	76	15-20	61 to 56	Shallow	<3.0
VP-15A (38-43)	10/21/2009	76	38-43	38 to 33	Shallow	<3.0
VP-15A (55-60)	10/21/2009	76	55-60	21 to 16	Intermediate	<3.0
VP-15A (77-82)	10/21/2009	76	77-82	-1 to -6	Deep	1.6 J (2)
VP-15A (99-104)	10/21/2009	76	99-104	-23 to -28	Deep	2.5 J (2)
VP-25A (99-104) Field Dup	10/21/2009	76	99-104	-23 to -28	Deep	2.9 J (2)

NOTES:

(1) - Data qualifier changed to "J" by data validation

(2) - Data not validated, but qualifier changed to "J" consistent with data validation

BOLD - indicates that value is greater that the perchlorate action level of 5 µg/L

Shaded - Indicates that value is greater than the EPA Interim Health Advisory Level of 15 µg/L

micrograms per Liter (µg/L) is equivalent to parts per billion

ftmsl - feet above mean sea level (NAVD 27)

ftbgs - feet below ground surface

J - Indicates a result is less than the reporting limit and estimated by the laboratory

TABLE 2-2
Current and Previous Off-Site Groundwater Vertical Profiling Perchlorate Results
Perchlorate Remedial Investigation
Shieldalloy Metallurgical Corporation
Newfield, New Jersey

Sample ID	Date Sampled	Approx. Ground Surface Elevation (ftmsl)	Sample Depth (ftbgs)	Approx. Sample Elevation (ftmsl)	Relative Aquifer Depth	Perchlorate (ug/L)
Vertical Profile Samples (2006/2007 Investigation)						
VP-1 (15-20)	11/28/2006	85	15-20	70 to 65	Shallow	<0.3
VP-1 (35-40)	11/28/2006	85	35-40	50 to 45	Shallow	<0.3
VP-1 (60-65)	11/29/2006	85	60-65	25 to 20	Intermediate	<0.3
VP-1 (85-90)	11/29/2006	85	85-90	0 to -5	Deep	**5.6**
VP-1 (105-110)	11/29/2006	85	105-110	-20 to -25	Deep	3.0
VP-2 (15-20)	11/30/2006	85	15-20	70 to 65	Shallow	<0.3
VP-2 (35-40)	12/1/2006	85	35-40	50 to 45	Shallow	4.2
VP-2 (60-65)	12/1/2006	85	60-65	25 to 20	Intermediate	**9.6**
VP-2 (85-90)	12/1/2006	85	85-90	0 to -5	Deep	**49.9**
VP-2 (110-115)	12/1/2006	85	110-115	-25 to -30	Deep	**9.4**
VP-3 (25-30)	12/4/2006	95	25-30	70 to 65	Shallow	<0.3
VP-3 (45-50)	12/5/2006	95	45-50	50 to 45	Shallow	<0.3
VP-30 (45-50) Field Dup	12/5/2006	95	45-50	50 to 45	Shallow	<0.3
VP-3 (70-75)	12/6/2006	95	70-75	25 to 20	Intermediate	**7.9**
VP-3 (95-100)	12/6/2006	95	95-100	0 to -5	Deep	**34**
VP-3 (115-120)	12/6/2006	95	115-120	-20 to -25	Deep	**28.3**
VP-4 (30-35)	12/11/2006	100	30-35	70 to 65	Shallow	1.3
VP-4 (50-55)	12/11/2006	100	50-55	50 to 45	Intermediate	1.3
VP-4 (75-80)	12/11/2006	100	75-80	25 to 20	Intermediate	3.3
VP-4 (75-80) Field Dup	12/11/2006	100	75-80	25 to 20	Intermediate	3.1
VP-4 (100-105)	12/11/2006	100	100-105	0 to -5	Deep	<0.3
VP-4 (121-126)	12/11/2006	100	121-126	-21 to -26	Deep	**6.8**
VP-10 (20-25)	12/15/2006	85	20-25	65 to 60	Shallow	2.4
VP-10 (35-40)	12/15/2006	85	35-40	50 to 45	Shallow	<0.3
VP-10 (60-65)	12/18/2006	85	60-65	25 to 20	Intermediate	3.4
VP-100 (60-65) Field Dup	12/18/2006	85	60-65	25 to 20	Intermediate	3.4
VP-10 (85-90)	12/18/2006	85	85-90	0 to -5	Deep	**17.4**
VP-10 (109-114)	12/18/2006	85	109-114	-24 to -29	Deep	**6.7**

NOTES:

(1) - Data qualifier changed to "J" by data validation

(2) - Data not validated, but qualifier changed to "J" consistent with data validation

BOLD - indicates that value is greater that the perchlorate action level of 5 µg/L

Shaded - Indicates that value is greater than the EPA Interim Health Advisory Level of 15 µg/L

micrograms per Liter (µg/L) is equivalent to parts per billion

ftmsl - feet above mean sea level (NAVD 27)

ftbgs - feet below ground surface

TABLE 2-3
Soil Investigation Perchlorate Results
Perchlorate Remedial Investigation
Shieldalloy Metallurgical Corporation
Newfield, New Jersey

Sample ID	Date Sampled	Sample Depth (ftbgs)	Perchlorate (ug/kg)
Background Sample			
SS-01 (0-1')	8/30/2012	0-1	<1.2
SS-01 (5-7')	10/26/2009	5-7	<9.6
SS-01 (12-14')	10/26/2009	12-14	<10
AOC-1 Former Chemical Storage Building			
SS-02 (1-3')	10/26/2009	1-3	2.1 J(1)
SS-02 (14-16')	10/26/2009	14-16	<9.7
SS-03 (0-2')	10/26/2009	0-2	<10
SS-03 (13-15')	10/26/2009	13-15	8.6 J(1)
SS-04 (0-1')	8/30/2012	0-1	<1.2
SS-04 (2-4')	10/26/2009	2-4	7.9 J(1)
SS-04 (14-16')	10/26/2009	14-16	4.2 J(1)
SS-05 (0-1')	8/30/2012	0-1	<1.2
SS-05 (5-7')	10/26/2009	5-7	58.3
SS-05 (13-15')	10/26/2009	13-15	18.3
SS-06 (1-3')	10/26/2009	1-3	<10
SS-06 (14-16')	10/26/2009	14-16	2.9 J(1)
SS-07 (6-8')	10/26/2009	6-8	<9.6
SS-27 (6-8') Field Dup	10/26/2009	6-8	<9.6
SS-07 (13-15')	10/26/2009	13-15	3.0 J(1)
SS-08 (3-4')	10/26/2009	3-4	<9.9
SS-08 (12-14')	10/26/2009	12-14	<9.6
AOC-2 Former Building D102(A)			
SS-21 (0-1')	8/30/2012	0-1	5.9 J(1)
SS-21 (1-3')	10/28/2009	1-3	11.0
SS-21 (5-7')	10/28/2009	5-7	10.7
SS-22 (1-3')	10/28/2009	1-3	<9.8
SS-22 (6-8')	10/28/2009	6-8	12.0
SS-23 (2-4')	10/28/2009	2-4	<10
SS-33 (2-4') Field Dup	10/28/2009	2-4	<10
SS-23 (6-8')	10/28/2009	6-8	<9.7
SS-24 (0-1')	8/30/2012	0-1	<1.2
SS-24 (1-3')	10/28/2009	1-3	26.5
SS-24 (4-6')	10/28/2009	4-6	28.8

Sample ID	Date Sampled	Sample Depth (ftbgs)	Perchlorate (ug/kg)
AOC-3 Former Lagoon Area			
SS-09 (0-1')	8/30/2012	0-1	<1.2
SS-09 (6-8')	10/26/2009	6-8	<10
SS-09 (12-14')	10/26/2009	12-14	<10
SS-10 (2-4')	10/26/2009	2-4	<9.8
SS-10 (4-6')	10/26/2009	4-6	<9.4
SS-11 (1-3')	10/27/2009	1-3	<9.8
SS-11 (5-7')	10/27/2009	5-7	2.8 J(2)
SS-12 (2-4')	10/27/2009	2-4	<9.7
SS-12 (5-7')	10/27/2009	5-7	<9.6
SS-32 (5-7') Field Dup	10/27/2009	5-7	<9.6
SS-13 (0-1')	8/30/2012	0-1	<1.2
SS-13 (1-3')	10/27/2009	1-3	2.0 J(2)
SS-13 (5-7')	10/27/2009	5-7	2.9 J(2)
SS-14 (1-3')	10/27/2009	1-3	<9.5
SS-14 (6-8')	10/27/2009	6-8	<9.6
SS-15 (0-1')	8/30/2012	0-1	<1.2
SS-15 (2-4')	10/27/2009	2-4	<9.7
SS-15 (4-6')	10/27/2009	4-6	<9.9
SS-16 (1-3')	10/27/2009	1-3	<9.6
SS-16 (6-8')	10/27/2009	6-8	<9.9
SS-17 (1-3')	10/27/2009	1-3	<9.7
SS-17 (5-7')	10/27/2009	5-7	2.8 J(2)
SS-18 (1-3')	10/27/2009	1-3	<10
SS-18 (6-8')	10/27/2009	6-8	<9.3
SS-19 (1-3')	10/27/2009	1-3	<9.8
SS-19 (6-8')	10/27/2009	6-8	<9.6
SS-20 (0-1')	8/30/2012	0-1	<1.2
SS-20 (1-3')	10/27/2009	1-3	2.3 J(2)
SS-20 (4-6')	10/27/2009	4-6	<10

NOTES:

(1) - Data qualifier changed to "J" by data validation

(2) - Data not validated, but qualifier changed to "J" consistent with data validation

EPA Regional Screening Level for perchlorate in residential soil is 55,000 µg/kg and 720,000 µg/kg in industrial soil.

Shaded results are in excess of the EPA Regional Screening Level for perchlorate.

micrograms per Liter (µg/kg) is equivalent to parts per billion

ftbgs - feet below ground surface

J - Indicates a result is less than the reporting limit and estimated by the laboratory

TABLE 2-4
Soil Investigation, Monitoring/Extraction Well Sampling, Groundwater Vertical Profiling, and Surface Water and Sediment QA/QC Results
Perchlorate Remedial Investigation
Shieldalloy Metallurgical Corporation
Newfield, New Jersey

Sample ID	Date Sampled	Perchlorate (µg/L)
Soil / Sediment Investigation Field Blank Samples		
FB102609(1)	10/26/2009	<3.0
FB102609(2)	10/26/2009	<3.0
FB102709(1)	10/27/2009	<3.0
FB102709(2)	10/27/2009	<3.0
FB102809(for SS Samples)	10/28/2009	<3.0
FB102809(for SED Samples)	10/28/2009	<3.0
Monitoring/Extraction Well Sampling Field Blank Samples		
FB102009A	10/20/2009	<3.0
FB102109	10/21/2009	<3.0
FB102209	10/22/2009	<3.0
FB111909	11/19/2009	<3.0
FB090810	9/8/2010	<3.0
FB090910	9/9/2010	<3.0
FB042911	4/29/2011	<3.0
Groundwater Vertical Profiling Field Blank Samples		
FB101209	10/12/2009	<3.0
FB101309	10/13/2009	<3.0
FB101409	10/14/2009	<3.0
FB101509	10/15/2009	<3.0
FB101609	10/16/2009	<3.0
FB101909	10/19/2009	<3.0
FB102009	10/20/2009	<3.0
FB102109	10/21/2009	<3.0
FB102209	10/22/2009	<3.0
FB102309	10/23/2009	<3.0
Environmental Samples / "Blind" Duplicate Samples		
Monitoring Well Sampling		
IWC-5 / IWC-6	10/21/2009	11.7 / 10.7
SC9S / SC33S	10/21/2009	8.2 / 8.0
SC32D / SC35D	10/22/2009	3.2 / 3.3
SC3D(R) / SC34D	10/21/2009	141 / 136
SC34D / SC37D	11/19/2009	150 / 152
SC36D / SC37D	9/8/2010	6.4 / 5.6
SC40D / SC49D	4/29/2011	4.0 / 3.9
K / J	9/9/2010	1.9J / 3.0
Groundwater Vertical Profiling		
VP-14(105-110) / VP-24(105-110)	10/19/2009	6.2 / 5.9
VP-15A(99-104) / VP-25A(99-104)	10/21/2009	2.5J / 2.9J
Soil Investigation*		
SS-07(6-8') / SS-27(6-8')	10/26/2009	<9.6 / <9.6
SS-12(5-7') / SS-32(5-7')	10/27/2009	<9.6 / <9.6
SS-23(2-4') / SS-33(2-4')	10/28/2009	<10 / <10
Surface Water / Sediment Investigation		
SED-4 / SED-10*	10/28/2009	10.9J / <42
SW-4 / SW-10	10/28/2009	<3.0 / <3.0

NOTES:

Action Level for Perchlorate is 5 µg/L (per Administrative Consent Order signed February 1, 2006).

micrograms per Liter (µg/L) is equivalent to parts per billion

J - Indicates a result is less than the reporting limit and estimated by the laboratory

* - Soil and sediment perchlorate results are presented in micrograms per kilogram (µg/kg)

TABLE 2-5
Surface Water and Sediment Investigation Perchlorate Results
Perchlorate Remedial Investigation
Shieldalloy Metallurgical Corporation
Newfield, New Jersey

Sample ID	Date Sampled	Perchlorate	
		Surface Water (ug/l)	Sediment (ug/kg)
Surface Water / Sediment Sample Identifications			
SW-1A / SED-1A	10/28/2009	1.8 J (1)	<12
SW-1 / SED-1	10/28/2009	<3.0	<18
SW-2 / SED-2	10/28/2009	<3.0	<19 (2)
SW-3 / SED-3	10/28/2009	<3.0	<13
SW-4 / SED-4	10/28/2009	<3.0	10.9 J (1)
SW-10 / SED-10 Field Dup	10/28/2009	<3.0 (2)	<42
SW-5 / SED-5	10/28/2009	<3.0	<27
SW-6 / SED-6	10/28/2009	<3.0	<16
SW-7 / SED-7	10/29/2009	<3.0	<21
SED-8	10/29/2009	Dry	<11
SW-9 / SED-9	10/29/2009	<3.0	<47

NOTES:

(1) - Data qualifier changed to "J" by data validation

(2) - Data validation indicated analytical result should be reported as less than the laboratory reporting limit

There are no established guidance or criteria for perchlorate in surface water or sediment

micrograms per Liter (µg/L) is equivalent to parts per billion

ftmsl - feet above mean sea level (NAVD 27)

ftbgs - feet below ground surface

J - Indicates a result is less than the reporting limit and estimated by the laboratory